BOOK REVIEWS

IGNEOUS MINERALS AND ROCKS by ERNEST E. WAHLSTROM. New York, John Wiley & Sons, 1947. 367 pages, 94 text figures. Price $5.50.

Professor Wahlstrom's very successful *Optical Crystallography* is now followed by a work on igneous minerals and rocks, designed to serve the requirements of a beginning student in microscopic igneous petrography. Following two chapters on optical and other methods of examining minerals, about a hundred pages are given to the description of the chief families and species that occur in igneous rocks. Here the author has made the wise decision to omit all very rare minerals, as well as doubtful or uncommon varieties. The descriptions are clear, adequate, and well illustrated by photographs and drawings. Next come 42 pages of tables for the identification of minerals, first in thin section and then with immersion media. These tables should be most helpful to students in the laboratory.

The second half of the book deals with igneous rocks. The reviewer wonders why the author did not extend to rocks the same wise discrimination that he applied to the minerals. It is fifty years since James Furman Kemp wrote that:

> "one only needs to compile a glossary to appreciate what numbers of unnecessary and ill-advised names for rocks burden this unfortunate branch of science, and to convince one that the philological petrographer comes near to being the enemy of his kind."

The reviewer fondly believed that at the present date the great majority of petrographers were of Kemp's opinion; so it was a blow to find that in this little book Professor Wahlstrom serves up no less than 459 varietal names (not counting compound names), most of which fully merit Kemp's description. What good can it do to a student to learn that "pilandite is a potash trachite" or that "leeuwfonteinite=hatherlite"? Who cares what these obsolete and unnecessary names mean? Scores of other names are equally worthless, but the beginning student has no means of knowing this. Even more discouraging (to the reviewer) than this revival of obsolete rock names is the author's claim that there is no justification for separating rocks containing a little quartz from those that contain a little feldspathoid. Does any chemist hold that there is no justification for separating acid solutions from alkaline solutions? To the reviewer, who has spent much of his petrographic lifetime in trying to persuade his colleagues to abandon the old concept of "rock species" and to look at rocks as chemical systems, Professor Wahlstrom's re-statement of the beliefs of fifty years ago is discouraging.

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NOTES ON OPTICAL MINERALOGY by GEORGE TUNELL. California Institute of Technology Bookstore, Pasadena, California, 1946, 39 pages. 15 illustrations. Price $2.80.

The petrographer seeking a thorough understanding of the elementary principles of optical mineralogy will welcome this collection of notes by a man who has long recognized unsatisfactory definitions of terms and serious inconsistencies and omissions in the treatment of both theory and methods in most American textbooks on the subject. Several comments in this connection are among the author's previous contributions to crystallography. The present notes supply much accurate information—not otherwise readily available—on the behavior of light waves in crystals without rotatory power, and hence they constitute a valuable supplement to textbooks. Owing to their development and publication chiefly for local use, these notes might well escape the attention of some persons interested in the subjects covered; hence a brief review of their contents seems in order.

Included in the text is much material carefully abstracted from the foreign literature,

particularly from Pockels' classic "Lehrbuch der Krystalloptik." The author's own paper on the ray surface, the optical indicatrix, and their interrelation is reproduced in full, with a revised statement on the use of the indicatrix in determining for a biaxial crystal the two wave-normal directions, refractive indices of the two waves, and the vibration directions and velocities of the two rays propagated along any given ray direction. Terms are carefully defined and discussed. For example, uniform usage of the term "vibration direction" in accordance with the electromagnetic theory of light propagation is strongly recommended, and the basic distinction between refractive index and ray index is clearly stated.

Proof of the law of Biot and Fresnel, discussion of Bertin's surface, and treatment of reflection and refraction by means of Huygen's construction and by means of the index surface follow the discussions of the indicatrix and the ray surface. All problems are solved by simple geometrical means, rather than in basic terms of mathematical equations. Advantages and limitations of methods are pointed out.

Collated data on six reference surfaces of optically biaxial crystals are presented in a simple tabular form that should greatly facilitate understanding of their respective characteristics. The reviewer knows of no such compilation in the English literature. A closing section entitled Optical Crystallography comprises a glossary of important terms; an outline of properties to measure and features to look for under the petrographic microscope; a table of crystal systems, crystal classes (point groups), optical classes, types of dispersion, and presence or absence of rotatory power; and a selected and partly annotated bibliography.

The petrographer will find these notes of considerable reference value for the theories underlying the rule-of-thumb methods commonly used in the laboratory, and the interested student of optical crystallography will find them a well-documented introduction to more advanced problems of light transmission through crystals.

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HANDBOOK OF URANIUM MINERALS by JACK DEMENT AND H. C. DAKE. Mineralogical Publishing Company, 329 S.E. 32nd Avenue, Portland 15, Oregon; 1947, 80 pages, price $1.50.

This booklet is an interesting, elementary compilation of data relating to the uranium and thorium minerals. It is written in a popular style and should prove of much interest to collectors, prospectors, and those desiring a handy, general introduction to the subject.

A chapter on the occurrence of uranium minerals gives a survey of their distribution throughout the world. It is somewhat uneven in its treatment of the occurrences in the various states and there are some omissions. For example, no mention is made in this chapter of the occurrence of carnotite at Mauch Chunk, Pennsylvania, nor of the occurrence of any uranium or thorium minerals in occupied Germany.

A chapter on the prospecting for and detection of uranium minerals presents a general discussion of the various methods. The description of the use of the Geiger-Müller counter by G. C. Ridland in the geologic survey of the pitchblende veins at Great Bear Lake, Canada, will be of particular interest.

Two chapters are devoted to the uranium and thorium minerals. Carnotite and pitchblende are treated in some detail in the first chapter. The second chapter gives brief data on each mineral. Comparison of the data on minerals, spelling of names, and synonomy, in this booklet with those in Volume 1 of *Dana's System of Mineralogy*, seventh edition, shows that the writers did not make full use of the treatment by Palache, Berman, and

Frondel. The description of the uranium and thorium minerals is not complete and it is surprising that allanite, gadolinite, and zircon are not mentioned as uranium or thorium bearing minerals.

The book is concluded with a selected bibliography, a reference to original papers on radioactive minerals, and five short appendices on radiochemical data.

The book appears to have been hastily compiled, as is indicated by the frequent misspellings and inconsistencies in the text.

GEORGE T. FAUST

THE MINERAL KEY by HOWARD B. GRAVES, JR. (Chemist, Research Division, International Minerals and Chemical Corporation; formerly Chemist, E. I. DuPont de Nemours; formerly Geologist, The Texas Company). 178 pages, $4\frac{1}{2}\times7$. McGraw-Hill Book Co., Inc., 1947. Price $4.00.

This book is designed especially for amateur mineralogists and mineral collectors. About 125 of the 178 pages are devoted to determinative tables listing 823 minerals. These tables are based on the usual physical properties (specific gravity not included), with supplementary chemical tests to confirm identification.

Keeping in mind that the reader is quite likely to have had no specialized training in mineralogy, the author has omitted a discussion of crystallography and has restricted his tests to those that involve only the common chemicals and the simpler apparatus. (Useful tests not listed include the Cassius purple test for gold; the dimethylglyoxime test for nickel; the ammonium molybdate test for phosphorus; also no tests for beryllium, cerium or platinum.)

Additional tables are given for minerals with fibrous and earthy textures and for members of the mica family (micas, chlorites and vermiculite).

The Mineral Key should prove helpful to prospectors, mining engineers and geologists located in places where laboratory facilities are very limited, but the high price of $4.00 seems excessive for so small a book without a single cut or illustration.

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THE DEVELOPMENT OF THE CHEMICAL ELEMENTS by N. EFREMOV.

The Development of the Chemical Elements is an 80-page treatise, in German translated from Ukrainian, by Dr. N. Efremov, Professor of Mineralogy and Petrography at the International UNRRA University in Munich, Germany. The paper-covered volume, which was published in 1946 under the authority of UNRRA Team 108 by Ludwig Storr, 5 Liebherr Street, Munich, embodies Dr. Efremov's ideas on the nature of geochemical changes and reactions. In the introduction the author draws an analogy between the man-made explosions at Hiroshima and Bikini and such "geological explosions" as the eruptions of Mont Pelée and Krakatau, and presents the hypothesis that the ultimate source of energy for the two is the same. In brief, the hypothesis, which he calls atomic heteromorphisis, states that transformation of elements (other than radioactivity) takes place within the earth and that this transmutation of atoms furnishes energy for many earth processes and is the basis for numerous petrological and mineralogical reactions.

The transformation reactions are divided into two types: (1) those which proceed without the introduction of other elements such as Mg+Mg=Na+Al+free energy, and (2) those which proceed with the addition of other elements as typified by He+Ca =Al+OH. Using these two types of reactions the author proceeds to write numerous mineralogical equations to embellish his ideas on petrogenesis. He advances the concept of

a primary dunitic magma from which many types of igenous rocks could be derived by elemental transformation. Olivine, which he regards as the original mineral, can be converted, through changes in the magnesium molecule, into any of the following: anorthite, albite, corundum, pyrope, enstatite, serpentine, spinel, nepheline, or orthoclase. Thus from dunite are derivable peridotite, pyroxenite, picrite, gabbro, basalt, diabase, serpentinite, albitite, essexite-basalt, atlantite, theralite, and nepheline syenite, among others.

The problems of serpentinization and the origin of feldspathoidal rocks are also examined from the viewpoint of the new hypothesis. The author rejects the idea that serpentine results from the action of water on olivine-rich rocks and substitutes the transformation reaction: Mg=4H+O+energy. The source of the feldspathoidal magma lies in the transformation previously cited, that of two molecules of magnesium into one of sodium and one of aluminum, by means of which olivine is changed to nepheline. According to the author this transformation "plays an unusually important role with respect to Ca and Mg in the life of the planet, for it postulates the origin of the alkalic aluminosilicate magmas."

Professor Efremov has presented some highly original thoughts on various petrological problems, and his hypothesis makes interesting reading. His enthusiasm for his brainchild is boundless, as witnessed by the following statement made in rejecting Bowen's theory of crystal differentiation: "These inadequacies (of Bowen's theory) are lacking in the hypothesis of heteromorphisis, for it devises an interpretation for all our known petrological and geological phenomena with striking simplicity and elegance." The chief weakness of the concept seems to lie in the assumption that atomic transmutation, other than radioactivity, is of a common and widespread occurrence within the earth. Under laboratory conditions enormous quantities of energy are required for elemental transformation, yet the author fails even to speculate regarding possible conditions for this phenomenon on a geological scale. The organizational pattern of the treatise is somewhat haphazard and increases the difficulty of following the sometimes abstruse argumentation. Most of the illustrations are only remotely concerned with the ideas advanced in the text.

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NEW MINERAL NAMES

Apoanalcite

Christoffer Oftedahl, Apoanalcite, a new mineral. *Norsk Geol. Tidsskrift*, **26**, 215–218 (1947).

Physical Properties: Red, massive, slightly columnar. Optically positive, uniaxial, nE=1.487, nO=1.475.

Chemical Properties: Analysis by Lars Lund (on 0.2 g. for the main portion and on 0.13 g. for alkalies): SiO_2 41.2, Al_2O_3 34.0, CaO 0.7., Na_2O 12.2, K_2O tr., H_2O 11.7; sum 99.8%. This gives $Na_{0.92}Ca_{0.03}Al_{1.55}Si_{1.59}O_6 \cdot 1.51\ H_2O$. The mineral therefore does not correspond to the normal zeolite type, in which each Al replacing Si is balanced by one Na. Dehydration study by Lars Lund gave a curve with a sharp break, 1.01% being lost at 300°, 9.40% at 420°.

Occurrence: In an erratic boulder of syenite pegmatite in a gravel pit at Voksen, 5 km. N. W. of Oslo. The specimen contains chiefly gray micro-perthite with some aegirine and biotite crystals. It is suggested that some of the massive red "natrolite" of this area may prove to be apoanalcite.

Discussion: The composition and the birefringence are distinct from those of normal analcime, but further study, especially x-ray, is needed.

Michael Fleischer